Subcutaneous Emphysema Following Open Tracheostomy During Tracheostomy Mask Ventilation

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Patient: Female, 64-year-old
Final Diagnosis: Subcutaneous emphysema following open tracheostomy during tracheostomy mask ventilation
Symptoms: Shortness of breath • wheeze
Medication: —
Clinical Procedure: —
Specialty: Anesthesiology • Critical Care Medicine

Objective: Unusual clinical course
Background: Tracheostomy is a surgical procedure that is done by creating an ostomy in the anterior wall of the trachea to facilitate airway access and ventilation. It is indicated for acute respiratory failure after prolonged intubation, upper airway obstruction, difficult airway, and extensive secretions. Early perioperative complications include bleeding, pneumothorax/pneumomediastinum from a false tract, subcutaneous emphysema, esophageal perforation, and tracheal ring fractures.

Case Report: We present the case of a 64-year-old woman with a past medical history of hypertension, asthma, alcohol and cocaine abuse, bipolar, and, right breast cancer that was treated by chemotherapy and total mastectomy. She was diagnosed with adductor spasmodic dysphonia of unknown etiology 6 months ago and has been treated with Botulinum toxin injection, with an incomplete resolution. She was admitted to the Respiratory Intensive Care Unit with acute hypoxic respiratory failure associated with laryngospasm, which was unresponsive to steroids and racemic epinephrine. She underwent an emergent open tracheostomy with a regular nonfenestrated tracheostomy tube. A few hours after surgery, she was weaned from mechanical ventilation to a tracheostomy mask oxygen and had an episode of strong cough followed by extensive neck and facial subcutaneous emphysema.

Conclusions: Subcutaneous emphysema is a rare complication but it can be catastrophic, especially if it is associated with pneumothorax and/or pneumomediastinum. Avoiding tight a tracheostomy tube strap and fenestrated tracheostomy tube is one of the measures that can be used to avoid this complication.

Keywords: Postoperative Complications • Subcutaneous Emphysema • Tracheostomy

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Background

Tracheostomy is a surgical procedure that is done by creating an ostomy in the anterior wall of the trachea to facilitate airway access and ventilation. It is indicated for acute respiratory failure after prolonged intubation, upper airway obstruction, difficult airway, and extensive secretions [1]. Early perioperative complications include bleeding, pneumothorax/pneumomediastinum from a false tract, subcutaneous emphysema, esophageal perforation, and tracheal ring fractures. Late complications occur in the setting of chronic tracheostomy tubes, which include airway stenosis, granulation tissue formation, tracheomalacia, and tracheoesophageal and tracheoinnominate fistulas [2]. Subcutaneous emphysema is rare but carries a high risk of morbidity and mortality, especially if progressed to pneumothorax and pneumomediastinum. It results from tight closure of tissues around the tracheostomy tube or tears in the posterior tracheal wall [3].

Case Report

Our patient was a 64-year-old woman with a past medical history of hypertension, asthma, alcohol and cocaine abuse, bipolar, and right breast cancer that was treated by chemotherapy and total mastectomy. Her home medications included albuterol-irratropium bromide (120 mcg-21 mcg) inhaler 2 puffs 4 times a day, metoprolol 25 mg orally 4 times a day, and lithium 300 mg orally 4 times a day. She had no known medication allergies. The patient was diagnosed with adductor spasmodic dysphonia of unknown etiology 6 months ago and was treated with Botulinum toxin injection with an incomplete resolution, 1 treatment every month; her last treatment was 2 weeks before the admission. The patient was admitted from a homeless shelter with a 2-week history of shortness of breath and productive cough. She was found to be in respiratory failure, with a respiratory rate (RR) of 28 cycles per minute, oxygen saturation of 90% with bilateral wheezes and diminished air entry in the lungs, and heart rate of 102 beats per minute, while the rest of her vital signs were normal. The arterial blood gas (ABG) analysis revealed pH 7.29, PCO2 58 mmHg, PO2 62 mmHg, and HCO3 28 mmol/L. The chest X-ray was unremarkable.

The patient was diagnosed with acute asthma exacerbation and was successfully managed with an albuterol nebulizer and steroids.

On admission day 4, the patient was transferred to the Respiratory Intensive Care Unit with acute hypoxic respiratory failure associated with stridor secondary to laryngospasm. Bilevel positive airway pressure was applied with a set of the fraction of inspired oxygen (FiO2) 0.45, inspiratory positive airway pressure of 20 mmHg and expiratory positive airway pressure of 10 mmHg. The episode lasted for 45 min and was unresponsive to steroids and racemic epinephrine. Her vital signs were respiratory rate of 28 cycles per minute, oxygen saturation of 88% with bilateral diminished air entry in the lungs, and heart rate of 112 beats per minute, while her other vital signs were normal. ABG showed pH 7.28, PCO2 60 mmHg, PO2 57 mmHg, and HCO3 28 mmol/L, and results of 12-lead electrocardiography were normal. The patient underwent an emergent open tracheostomy with a regular non-fenestrated tracheostomy tube size 6 mm, under general anesthesia. She was intubated using a laryngoscope. Propofol, fentanyl, and rocuronium were used for induction, and sevoflurane was used for maintenance. During the procedure, the lowest oxygen saturation was 88%, which lasted for 20 s; otherwise, the patient was hemodynamically stable. Three hours after surgery, she was weaned from mechanical ventilation/volume control with a tidal volume of 400 ml, RR 12 cycles/minute, a FiO2 of 0.3 to a tracheostomy mask with an oxygen flow rate of 4 L/min. Four hours later, she had an episode of strong cough followed by extensive neck and facial subcutaneous emphysema and was found to have a tight tracheostomy tube strap. The subcutaneous emphysema was shown on the clinical exam and confirmed by X-ray (Figure 1). The chest X-ray was negative for pneumothorax (Figure 2). The tracheostomy tube strap was loosened and the patient was started on intravenous dexametomidine infusion of 0.5 µg kg⁻¹ min⁻¹, Lidocaine nebulization 4 times a day as needed, and 1 dose of 2 mg of intravenous midazolam. The patient’s respiratory status was stable with RR 18 and oxygen saturation of 98% on a tracheostomy mask with an oxygen flow rate of 4 L/min, which was applied for 16 h. High-flow nasal cannula oxygen therapy was not needed. The dexmedetomidine infusion

Figure 1. Extensive surgical emphysema in the soft tissues of the neck (blue arrow) and retropharyngeal space (red arrow).
was discontinued after 6 h. Two days later, the patient’s subcutaneous emphysema subsided and she made a full recovery. No cough suppressants were used preoperatively.

**Discussion**

In our case, subcutaneous emphysema, which is described as the presence of air in the subcutaneous tissue, happened because the patient had episodes of strong cough in the setting of tight soft tissue around the tracheostomy tube. It is unclear if the patient had a tracheal tear. From the neck X-ray, it was difficult to determine the mechanism of injury. Generally, the risk factors include extensive tissue dissection, tracheostomy tube obstruction, high-pressure mechanical ventilation [4], and the use of a fenestrated tracheostomy tube [5]. Our patient did not have any of these risk factors. Its incidence has been reported more with the percutaneous placement technique [6]. Subcutaneous emphysema in itself is a self-limiting and benign condition and generally the air will get absorbed. However, serious complications can occur, including skin necrosis, airway compression pneumomediastinum, and pneumothorax. The first step of management is identifying and treating the mechanism of insult and this eventually leads to gradual improvement of the subcutaneous emphysema [7]. In our case, we identified that the tight tracheostomy tube strap in the setting of a strong cough was the possible mechanism.

In severe cases, administration of a high concentration of oxygen is helpful, especially in patients with pneumothorax and/or pneumomediastinum. Patients with a severe form of subcutaneous emphysema can be treated surgically with bilateral infraclavicular 2-cm incisions [7]. It has also been reported that the application of low suction through a subcutaneous drain can be effective [8]. Multiple large and small tubings with or without manual decompression have been successfully used [9]. The management of emphysema secondary to posterior tracheal wall tear consists of bypassing the tear and allowing it to heal, or suturing, depending on the size of the injury [10]. Our patient had a mild form of subcutaneous emphysema that resolved after loosening of the tracheostomy tube strap and symptomatic supportive procedures: applying a tracheostomy mask with an oxygen flow rate of 4 L/min for 16 h, antitussives, and sedatives.

**Conclusions**

Subcutaneous emphysema is a rare complication but it can be catastrophic, especially if it is associated with pneumothorax and/or pneumomediastinum. Avoiding a tight tracheostomy tube strap and fenestrated tracheostomy tube is one of the measures that can be used to avoid this complication.

**Department and Institution Where Work Was Done**

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**References:**